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## SMC3 AS A TEST TO THE BINARY EVOLUTION

Krystian Iłkiewicz<sup>1</sup>, Joanna Mikołajewska<sup>1</sup> and Krzysztof Belczyński<sup>2</sup>

**Abstract.** SMC 3 is one of the most interesting symbiotic stars. This binary contains a bright K-type giant transferring mass to a massive white dwarf companion, which makes it a very promising SN Ia candidate. We discuss the evolutionary status of the system using results of population synthesis code.

### 1 Introduction

SMC 3 is one of the symbiotic systems in the Magellanic Clouds. The system contains a WD and an M giant with an orbital period of 4.5 years (eg. Kato *et al.* 2013). It is a supersoft X-ray source powered by a steady hydrogen burning on the surface of the white dwarf (Orio *et al.* 2007). Because the system contains a massive white dwarf ( $M_{WD} > 1.18 M_{\odot}$ ; Orio *et al.* 2007) with a high accretion rate ( $\dot{M} \simeq 10^{-7} M_{\odot}/\text{yr}$ ; Kahabka 2004) it is considered as one of the most promising supernova Ia progenitors among the known symbiotic population.

### 2 Model

To estimate the mass of the red giant we used the fact that it pulsates with a period of 110 days (Kahabka 2004). SMC 3 lies on the sequence B in the K-log(P) plane (Wood 2000) which suggests the first overtone pulsation. Assuming the pulsation constant of  $Q=0.04$  we derived the mass of  $2.3^{+0.6}_{-0.3} M_{\odot}$ .

To carry out our analysis we used the StarTrack population synthesis code (Belczyński *et al.* 2008). The code includes the wind accretion through Bondi-Hoyle mechanism, Roche-lobe overflow, *atmospheric* Roche-lobe overflow and *wind* Roche-lobe overflow. As initial conditions we adopted the current parameters of the system and then we modeled its future evolution. We assumed  $M_{\text{Ch}}=1.44 M_{\odot}$  and, since we studied the system in the SN Ia context, a CO WD.

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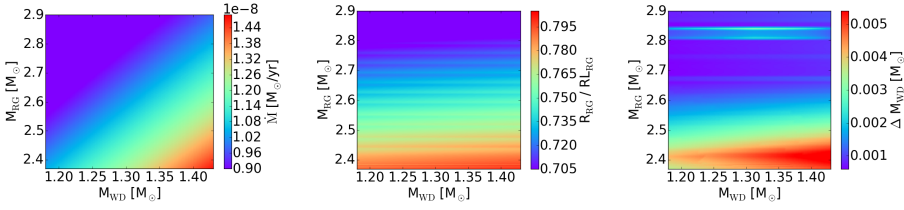
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<sup>1</sup> Nicolaus Copernicus Astronomical Centre, Bartycza 18, 00716 Warsaw, Poland

<sup>2</sup> Warsaw University Observatory, Al. Ujazdowskie 4, 00-478 Warszawa, Poland

### 3 Results

For all of our models the system went through a common envelope (CE) after  $\sim 10^5$  yrs and for none of the models system WD managed to accumulate enough matter to become a type Ia supernova. The orbital separation after the CE was relatively big ( $a \simeq 50 - 200 R_\odot$ ), which makes a merger in the Hubble time unlikely. The obtained parameters of the system are presented in Fig. 1.



**Fig. 1.** Left panel: Predicted accretion rate on the WD. Middle panel: Roche lobe filling factor of the red giant. Right panel: Predicted mass growth of the WD before CE.

### 4 Conclusions

We predict that the system will not become a type Ia supernova in contrary to what was suggested in the literature (Orio *et al.* 2007). The caveat is that our predicted mass transfer rate is somewhat lower than the one expected for the steady hydrogen burning on the surface of the white dwarf (Nomoto *et al.* 2007). A lower  $\dot{M}$  than expected could be due to the fact that our model underestimates the RG mass loss through wind by treating it as in the single star scenario, whereas there is a strong observational evidence that this wind is significantly enhanced due to tidal interactions in SySt (Mikołajewska *et al.* 2002). Large Roche lobe filling factor suggests ellipsoidal variability in the system.

### References

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